Advanced Monolithic Systems

AMS285-2.5/AMS385-2.5

MICROPOWER VOLTAGE REFERENCE DIODE

RoHS compliant

FEATURES

- **±20 mV (±0.8%) max. initial tolerance (A grade)**
- **Operating Current 20μA to 20mA**
- **Low Voltage Reference 2.5V**
- **Max. 0.6Ω Dynamic Impedance (A grade)**
- **Low Temperature Coefficient**
- **1.2V Device and Adjustable Device also available AMS285-1.2 and AMS285 series, respectively AMS385-1.2 and AMS385 series.**

APPLICATIONS

- **Battery Powered Systems**
- **Instrumentation**
- **A/D, D/A Converters**
- **Temperature measurement**
- **Current sources**
- **Notebook/Personal Computer**
- **Monitors/ VCR/ TV**
- **Pagers**

GENERAL DESCRIPTION

The AMS285-2.5/AMS385-2.5 are two-terminal micropower band-gap voltage reference diodes. They feature a very low dynamic impedance and good temperature coefficient, operating over a 20μA to 20mA current range. On-chip trimming is used to provide tight voltage tolerance. Since the AMS285-2.5/AMS385-2.5 is a band-gap reference, uses only transistors and resistors, low noise and good long term stability result. Careful design of the AMS285-2.5/AMS385-2.5 has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows its use with widely varying supplies with excellent regulation. The extremely low power drain of the AMS285-2.5/AMS385-2.5 makes these reference diodes useful for micropower circuitry. These voltage references can be used to make portable meters, regulators or general purpose analog circuitry with battery life approaching shelf life. Further more, the wide operating current allows it to replace older references with a tight tolerance part.

The AMS285-2.5 is operational in the full industrial temperature range of -40°C to 85°C while AMS385-2.5 is operating over a 0°C to 70°C temperature range. The AMS285-2.5/AMS385-2.5 are available in TO-92, SO-8 and SOT-89 packages.

ORDERING INFORMATION:

TOL.	PACKAGE TYPE			OPERATING TEMPERATURE RANGE
	TO-92	8 LEAD SOIC	SOT-89	
±20mV	AMS285-2.5AN	AMS285-2.5AS	AMS285-2.5AL	-40 to 85° C
±38mV	AMS285-2.5BN	AMS285-2.5BS	AMS285-2.5BL	-40 to 85° C
±75mV	AMS285-2.5CN	AMS285-2.5CS	AMS285-2.5CL	-40 to 85° C
±20mV	AMS385-2.5AN	AMS385-2.5AS	AMS385-2.5AL	0 to 70° C
±38mV	AMS385-2.5BN	AMS385-2.5BS	AMS385-2.5BL	0 to 70° C
±75mV	AMS385-2.5CN	AMS385-2.5CS	AMS385-2.5CL	0 to 70° C

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ABSOLUTE MAXIMUM RATINGS

Reverse Current	30mA	Storage temperature	-55°C to +150°C
Forward Current	10mA	Soldering information (25 sec)	265°C
Operating Temperature Range			
AMS285-2.5	-40°C to 85°C		
AMS385-2.5	0°C to 70°C		

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at I_R = 100 µA, and T_A = +25°C unless otherwise specified.

Parameter	Conditions	AMS285A-2.5			AMS285B-2.5			AMS285C-2.5			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage (Note 4)	I_R - 100 µA	2.480	2.500	2.520	2.462	2.500	2.538	2.425	2.500	2.575	V
Reverse Dynamic Impedance (Note 4)	I_R - 100 µA, f =20Hz		0.2	0.60		1			1		Ω
Reverse Breakdown Voltage Change with current (Note 4)	10µA ≤I_R ≤1mA 1mA ≤I_R ≤20mA		1.0 10				1.0 10			2.0 20	mV
Min. Operating Current (Note 4)			12	18 **20**		13	20 **30**		13	20 **30**	µA µA
Wide Band Noise (Note 5)	I_R - 100 µA, 10Hz ≤ f ≤ 10kHz		120			120			120		µV
Temperature Coeff. (Note 6)			**25**			**50**			**100**	**150**	ppm/°C
Long Term Stability (Note 5)	T_A=25°C±.1°C T = 1000 Hr		20			20			20		ppm

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at I_R = 100 µA, and T_A = +25°C unless otherwise specified.

Parameter	Conditions	AMS385A-2.5			AMS385B-2.5			AMS385C-2.5			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage (Note 4)	I_R - 100 µA	2.480	2.500	2.520	2.462	2.500	2.538	2.425	2.500	2.575	V
Reverse Dynamic Impedance (Note 4)	I_R - 100 µA, f =20Hz		0.2	0.60		1			1		Ω
Reverse Breakdown Voltage Change with Current (Note 4)	10µA ≤I_R ≤1mA 1mA ≤I_R ≤20mA		1.0 10				2.0 20			2.0 20	mV
Min. Operating Current (Note 4)			12	18 **20**		13	20 **30**		13	20 **30**	µA µA
Wide Band Noise (Note 5)	I_R - 100 µA, 10Hz ≤ f ≤ 10kHz		120			120			120		µV
Temperature Coeff. (Note 6)			**25**			**50**			**100**	**150**	ppm/°C
Long Term Stability (Note 5)	T_A=25°C±.1°C T = 1000 Hr		20			20			20		ppm

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Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

Note 2: For elevated temperature operation, T_j max is:

AMS285	+125°C
AMS385	+100°C

Thermal Resistance	TO-92	SO-8	SOT-89
φ_{JA} (junction to ambient)	170°C/W (0.125" leads)	165°C/W	160°C/W

Note 3: Parameters identified with **boldface type** apply at temperature extremes. All other numbers apply at $T_A = T_J = 25°C$.

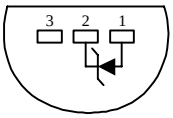
Note 4: Guaranteed and 100% production tested.

Note 5: Guaranteed but not 100% production tested. These limits are not used to calculate average outgoing quality levels.

Note 6: The average temperature coefficient is defined as the maximum deviation of reference voltage at all measured temperatures between the operating $T_{MAX\ and}$ T_{MIN}, divided by T_{MAX} - T_{MIN}. The measured temperatures are 0°C, 25°C, 70°C and 85°C.

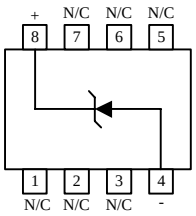
PIN CONNECTIONS

TO-92
Plastic Package (N)



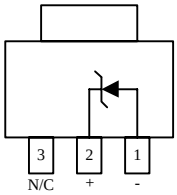
Bottom View

8L SOIC
SO Package (S)



Top View

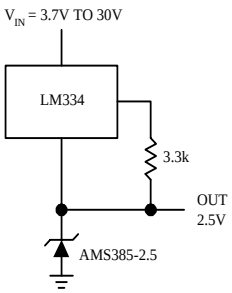
SOT-89
(L)



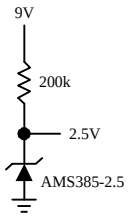
Top View

TYPICAL APPLICATIONS

Wide Input
Range Reference



Micropower Reference
from 9V Battery



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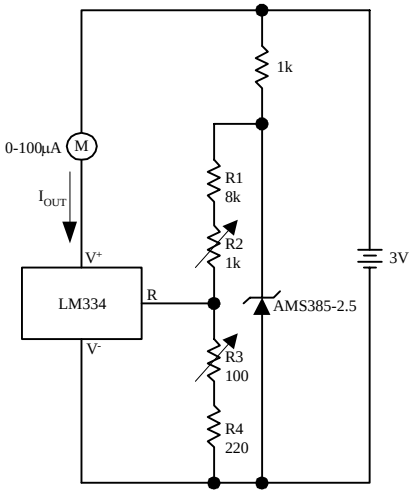
TYPICAL APPLICATIONS (Continued)

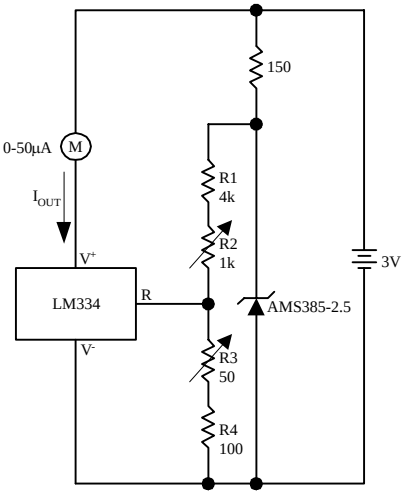
0°C - 100°C Thermometer



Calibration

1. Short AMS385-2.5, adjust R3 for I_{OUT} = temp at 1µA/°K
2. Remove short, adjust R2 for correct reading in °C

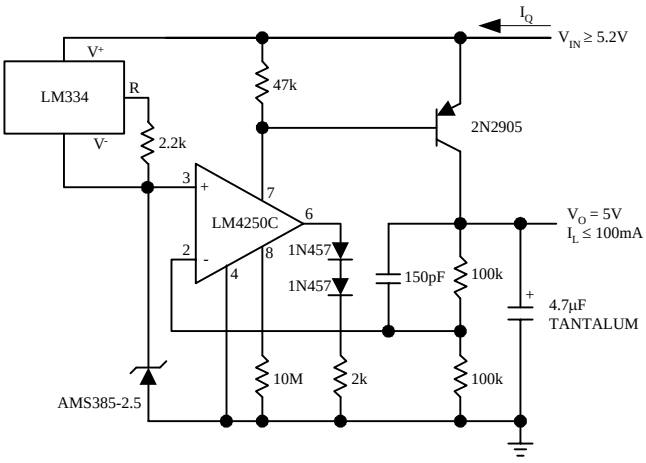
0°C - 100°C Thermometer



Calibration

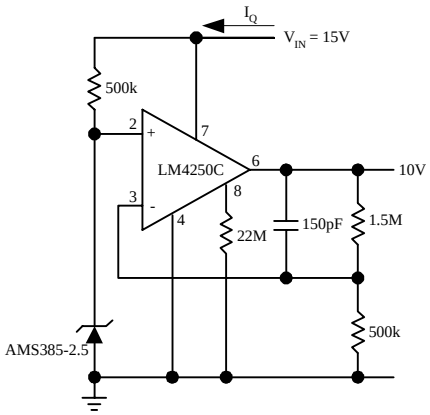
1. Short AMS385-2.5, adjust R3 for I_{OUT} = temp at 1.8µA/°K
2. Remove short, adjust R2 for correct reading in °F

Micropower* 5V Regulator



*$I_Q \cong 40\mu A$

Micropower* 10V Reference



*$I_Q \cong 20\mu A$ standby current

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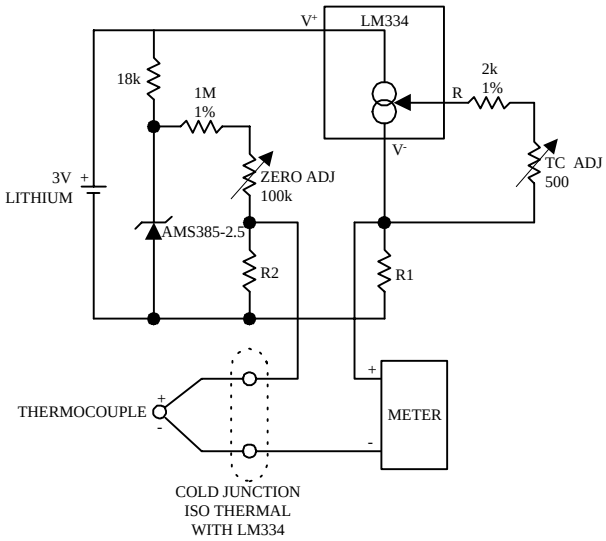
TYPICAL APPLICATIONS (Continued)

Micropower Thermocouple Cold Junction Compensator



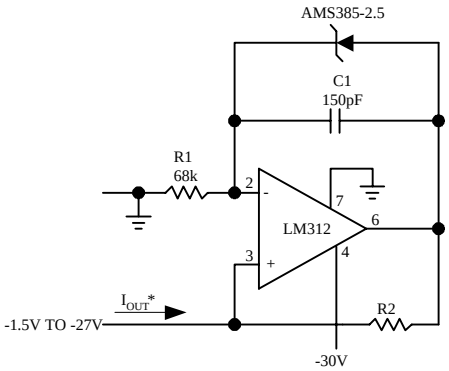
Adjustment Procedure

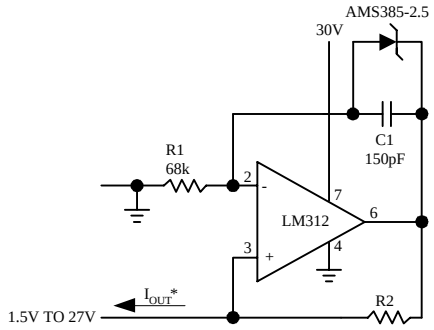
1. Adjust TC ADJ pot until voltage across R1 equals Kelvin temperature multiplied by the thermocouple Seebeck coefficient.
2. Adjust ZERO ADJ pot until voltage across R2 equals the thermocouple Seebeck coefficient multiplied by 273.2.

Thermocouple Type	Seebeck Coefficient (mV/ °C)	R1 (Ω)	R2 (Ω)	Voltage Across R1 @ 25°C (mV)	Voltage Across R2 (mV)
J	52.3	523	1.24k	15.60	14.32
T	42.8	432	1k	12.77	11.78
K	40.8	412	953Ω	12.17	11.17
S	6.4	63.4	150Ω	1.908	1.766

Typical supply current 50µA

Precision 1µA to 1mA Current Sources





*I_{OUT} =2.5V/R2

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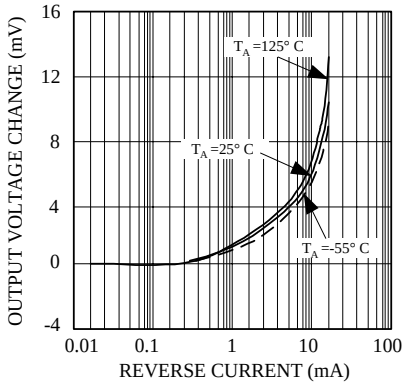
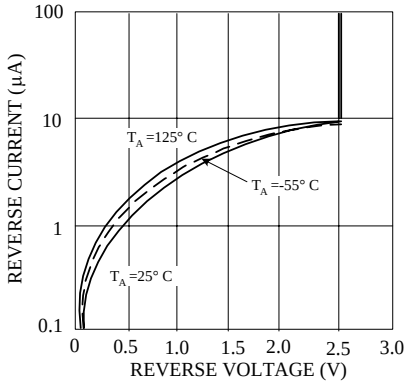
TYPICAL PERFORMANCE CHARACTERISTICS

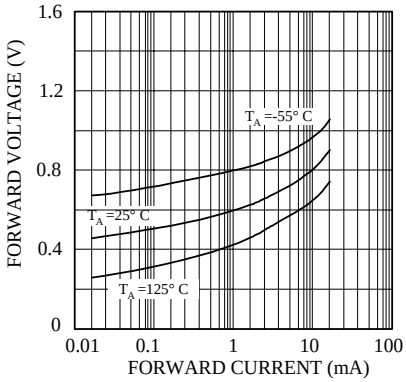
Reverse Characteristics



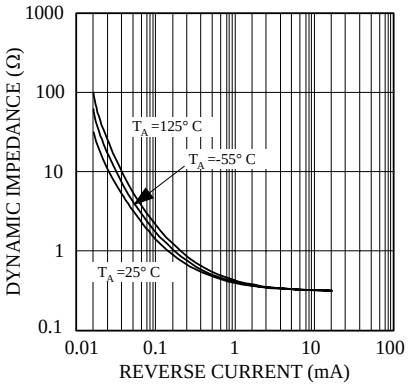
Reverse Characteristics



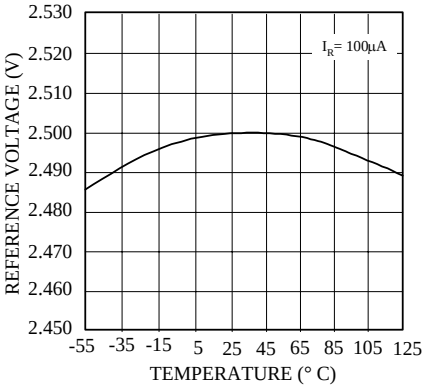
Forward Characteristics



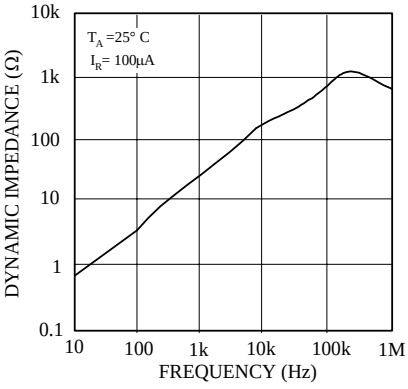
Reverse Dynamic Impedance



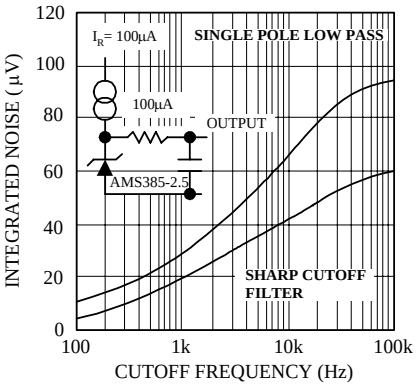
Temperature Drift



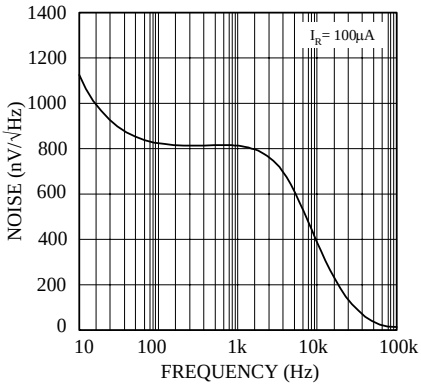
Reverse Dynamic Impedance



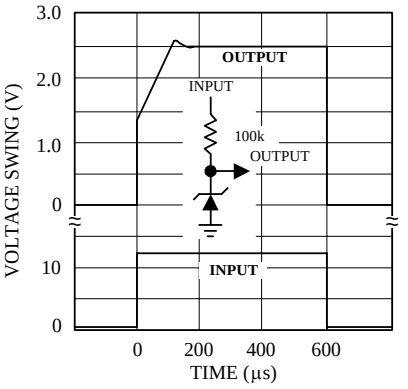
Filtered Output Noise



Noise Voltage



Response Time



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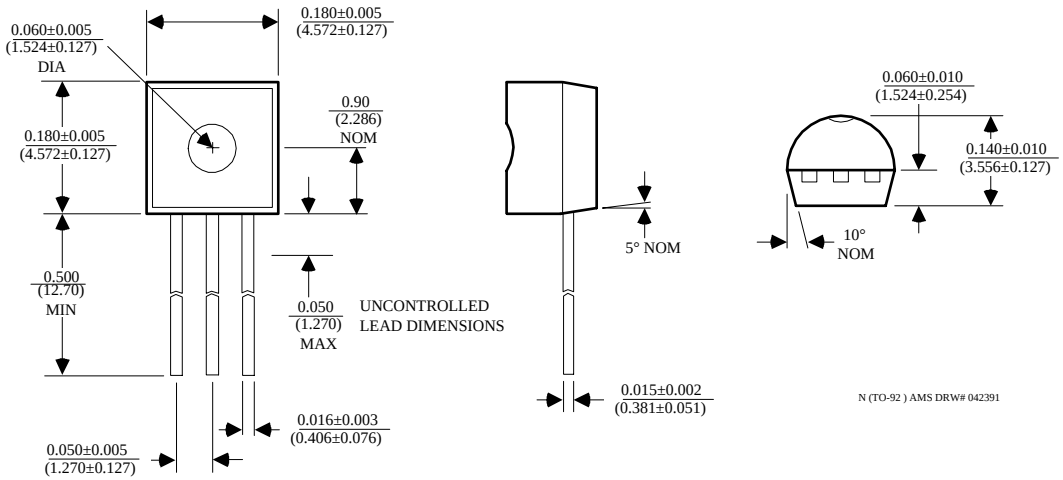
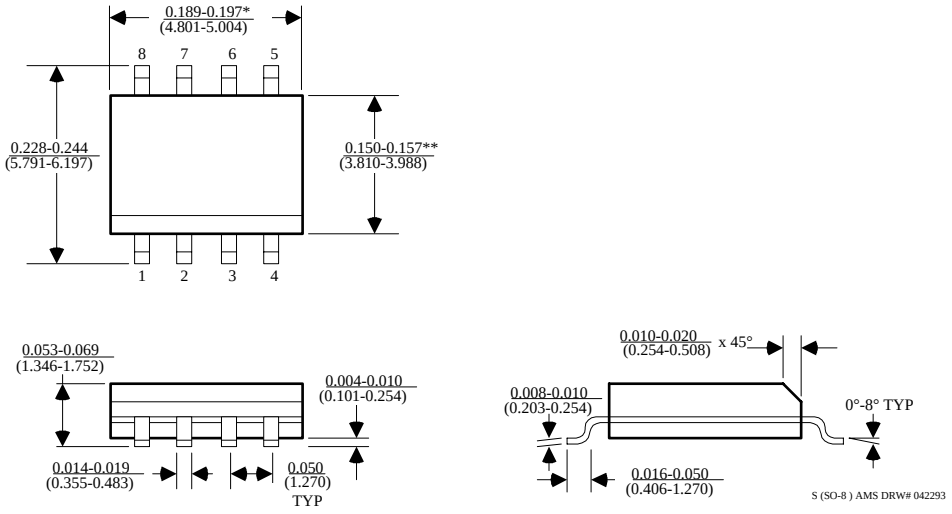
PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

3 LEAD TO-92 PLASTIC PACKAGE (N)



8 LEAD SOIC PLASTIC PACKAGE (S)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

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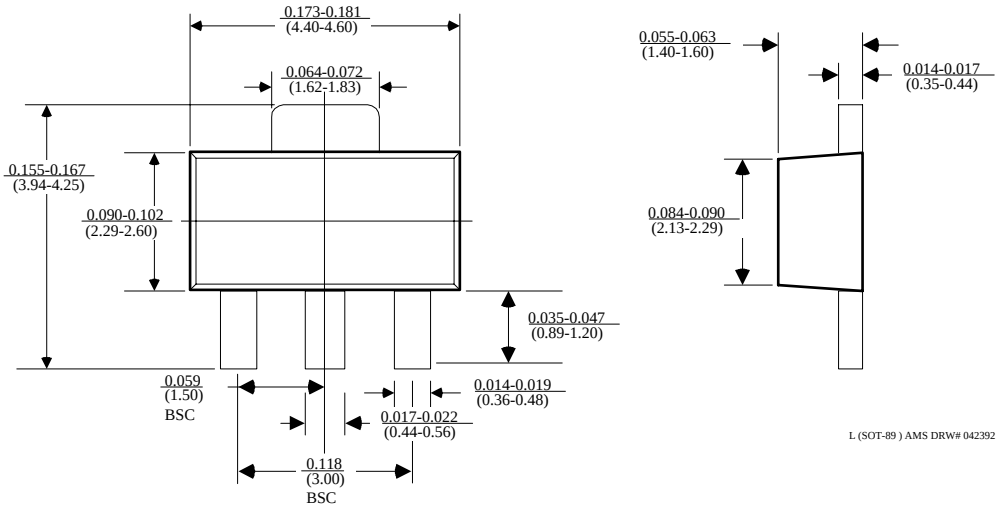
PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted (Continued).

SOT-89 PLASTIC PACKAGE (L)



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